In search of a (WEF) Nexus approach

IN SEARCH OF A (WEF) NEXUS APPROACH

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Abstract

The water, food and energy (WEF) nexus is viewed as a fresh way of thinking about related issues. This has resulted in calls for a WEF nexus approach which is systemic, can handle its associated complexity, ambiguity and vagueness, as well as the multiple stakeholders, each with their respective viewpoint, and the implied governance implications. In response, the Cybernetic Methodology, a Problem Structuring Method, is offered as an approach to frame these issues. This permits the concept of WEF nexus to be examined and associated governance issues to be modelled, acknowledging the multi-level nature of governance, in particular, the need for co-ordination. This is illustrated drawing upon examples from the Mekong River Basin. It is concluded that this approach not only offers the capability of handing the situation relating to WEF nexus, but that its emphasis upon action and closure enhances collaborative engagement by its disparate participants.

Keywords: WEF Nexus, Systems, Cybernetics, Problem Structuring Methodology, Viable System Model, Mekong

1.0 Introduction

The global challenges rising from population growth and climate change are drawing increasing attention to the question of how to meet future requirements for water, food and energy (WEF), against a backdrop of natural resources that are limited and being degraded through exploitation. This has resulted in a growing international debate about the need for a 'nexus approach' (e.g. Hoff, 2011; Finley & Seiber, 2014). One which shifts attention from treating water, food and water separately, resulting in sub-optimal decisions, to one adopting 'systems thinking' that allows issues to be addressed in a more sustainable and integrated way (Bazilian et al, 2011). Moreover, integration should extend the governance structures, but creates the challenge of how to improve co-ordination throughout (Pahl-Wostl, 2017). Consequently, nexus is presented as the 'new kid on the block' that offers "a (magical) solution that will quickly solve long-term fundamental and structural issues" (Allouche et al., 2014: 622).

However, the concept of 'nexus' in the context of sustainable water, food and energy is clothed in ambiguity. It origins are attributed to the World Bank who introduced the phrase "water, food and trade nexus" (Allan, 2003, citing McCalla, 1997). It appeared in Rio +20 in the context of energy in association with other sustainable development factors such as health, education and environmental protection as well as water and agriculture (UNDESA, 2012). Whilst it is associated with issues of sustainability, Allouche et al. (2014) argue that it also pertains to concerns about security (e.g. food security). However,

the term ‘nexus’ has been used without explanation (e.g. Water in the West, 2013). This is perhaps exacerbated due to its lack of definition (Endo et al., 2017). This is compounded by the view that the concept of nexus introduces complexity, due to “the need to view water, energy and food not as being separate, but as being complex and inextricably entwined” (Flammini et al., 2014: 12), but this inherent complexity is unclear (Endo et al., 2017).

In contrast to the view of nexus as concept is the view of nexus as process - an approach. Endo et al. (2017: 22) states that “the nexus is internationally interpreted as a process to link ideas and actions of different stakeholders under different sectors and levels for achieving sustainable development”. Evaluating nexus literatures, Keskinen et al. (2016) identify three views of what constitutes the WEF nexus. The first is a systematic analytical approach. However, it is unclear what this approach is, it lacks practical guidance (Stein et al., 2014; Keskinen et al., 2016). The second is a governance framework, though there is no single governance model that can address all situations (Stein et al., 2014). The third is to view the concept of nexus as a ‘boundary object’ which orients different stakeholders in collective discourse. Whilst, this facilitates different actors to engage in co-operative discussion, this invites an approach that accommodates the highly political nature of nexus issues. Whilst this may perhaps break deadlock on specific issues, it could also lead to paralysis (Keskinen et al., 2016). Keskinen et al. (2016) propose that the ideal nexus approach is one which integrates these three perspectives. Thus, there have been calls that the nexus approach is a ‘system-wise approach’ (ICIMOD, 2012) or ‘holistic’ (IISD, 2013), invoking an underlying ‘systems thinking’ perspective (Bazilian et al, 2011; Al-Saidi & Elagib, 2017). However, Wichelns (2017) questions claims about the utility of the nexus approach, stating that:

> Most of the statements are not supported by citations from the literature, a supporting conceptual framework, or empirical evidence. Lacking such support, it is not clear how implementing a nexus approach is either necessary or sufficient to achieve success (Wichelns, 2017: 119)

Further, vagueness about the term ‘nexus’, has led to the suggestion that ‘nexus’ is a ‘buzzword’ (Stein et al., 2014; Cairns & Krzywoszynskab, 2016). As a buzzword, users can play on its vague yet normative appeal (Cornwall, 2007) in raising awareness of the interplay between water, energy and food. In contrast, both Muller (2015) and Smajgl et al. (2016) present the WEF nexus as a ‘new paradigm’. Smajgl et al. (2016), argue that nexus characterises a shift away from a hydro-centric approach. For Muller (2015: 689) nexus “shifts the focus of water resources management from watersheds to problem-sheds, from what society should do for water to what water can do for society”. However, Endo et al. (2017), in their review of literature, have detected that studies have tended to emphasise institutional stakeholders, with no connectivity between community issues and higher level issues (e.g. national and global). Nevertheless, Muller (2015) argues that attention is turning away from seeking global solutions, towards local pragmatic solutions, but which are globally supported with appropriate governance mechanisms.

In summation, the vagueness and ambiguity that has been associated with the WEF nexus creates the challenge of how to make sense of the complexity associated with the WEF nexus in such a way as to enable appropriate action. Further, it needs to address two prominent issues – sustainability and governance. This calls for an integrative approach to thinking about these issues, invoking a ‘systems thinking’ approach. Such an approach is one which allows the requisite stakeholders to be identified and organised so that the

situation pertaining to the WEF nexus can be effectively evaluated and appropriate action implemented.

The contribution of this paper is to present an approach that addresses the complexity that characterises the WEF nexus. In response to calls for a systems approach to WEF nexus, this paper offers a Problem Structuring Method (PSM), the Cybernetic Methodology. The presents a systemic approach to guide the handling of complex situations characterised by vagueness, uncertainty and ambiguity. In this paper, the proposed methodology is used to guide the development of models which aim to clarify the concept of WEF nexus as well as address both sustainability and governance issues. The Mekong River Basin, (MRB) is used for illustration, drawing upon both the Mekong River Commission and Thailand's 'New Theory' which applies to the level of the farm.

2.0 A Cybernetic Methodology for WEF Nexus

The development of any approach to WEF nexus requires an understanding of that, the situation, which it is required to handle. The following section examines this requirement and in the subsequent section, presents the Cybernetic Methodology as a response.

2.1 What is Required from a WEF Nexus Approach

One methodology is offered by IISD (2013). This both defines the elements of the WEF nexus in an analytical model, as well as presents a methodology which supports the use of the model to guide discussion and evaluation. However, whilst it calls for stakeholder participation, what is presented is effectively a learning process utilising the models to effect solutions and change. It is unclear how the appropriate stakeholders are identified and enrolled. Indeed, Stein et al. (2014) focus upon one stakeholder regarded as central to any approach – the 'actor' defined as the "people who are actually affected by nexus challenges or try to address them" (Stein et al., 2014: 8). These actors comprise a plurality of diverse views and operate within a complex social network of relationships. However, it is necessary to establish who the key actors are, how they can be organised and how this collective action is governed, especially the role of co-ordination (Stein et al., 2014). Stein et al. (2014) argue that any approach needs to be able to handle complexity, embrace lack of predictability / uncertainty and aid problem definition.

This resonates with Stirling's (2015) view that different stakeholders frame problems to reflect their viewpoints. Thus, problems and possibilities need to be understood and appreciated, against the shaping backdrop of politics and power relationships. Moreover, change is more likely to arise from horizontal collaborations rather than vertical drivers in effecting change. There is not 'one right answer', but rather, there are 'answers appropriate to the framing of the problem', Further, that the handling of nexus complexity is underpinned by risk, ambiguity, uncertainty and ignorance. Stirling concludes: "what is clear is that what is needed is a general methodology under which can be harnessed a diverse mix of complementary methods" (Stirling, 2015: 16). However, Stirling also states that any methodology claiming this "can be a tricky aspiration to justify" (Stirling, 2015: 16). Further, political pressure for convenience / expediency can be to the cost of rigour / robustness.

A desirable methodology not only guides the learning process, subsuming different methods, but also facilitates evaluation of the organisational aspects of the learning

process. It thereby creates conditions conducive for determining the requisite stakeholders that are necessary for defining what the appropriate problem is, establishing the solution and implementing it. Thus, it emphasises the organisational and regulative (governance) aspects underpinning an effective learning process. This pertains to the cybernetics of the situation as distinct from, but intertwined with, the learning process. At its core is the handling of complexity, uncertainty and ambiguity. Such methodologies are embraced under the umbrella of Problem Structuring Methods (Mingers & Rosenhead, 2004), of which the 'Soft Systems Methodology' (Checkland, 1972, 1981, 1999) is most prominent.

2.2 The Cybernetic Methodology

Whilst the 'Soft Systems Methodology' is an empirically grounded methodology, which emphasises the learning process, a conceptually grounded methodology is offered here which gives explicit attention to the cybernetics of the situation which underpins the learning process: the 'Cybernetic Methodology' (Figure 1). It was developed by Raul Espejo (1988) and renamed as the VIPLAN Methodology in Bowling & Espejo (2000). Since its original publication, it has been presented in Espejo, (1990), Espejo et al. (1997), Bowling & Espejo (1992, 2000), Harwood, (2011), Espejo & Reyes (2011) and Espejo (2015a, 2015b). Due to the manner of it use in this paper and thus to distinguish this from the VIPLAN Methodology, it will be referred to by its initial name, Cybernetic Methodology. The methodology is applied to situations characterised by uncertainty and ambiguity, i.e. are wicked (Churchman, 1967) or messes (Ackoff, 1974).

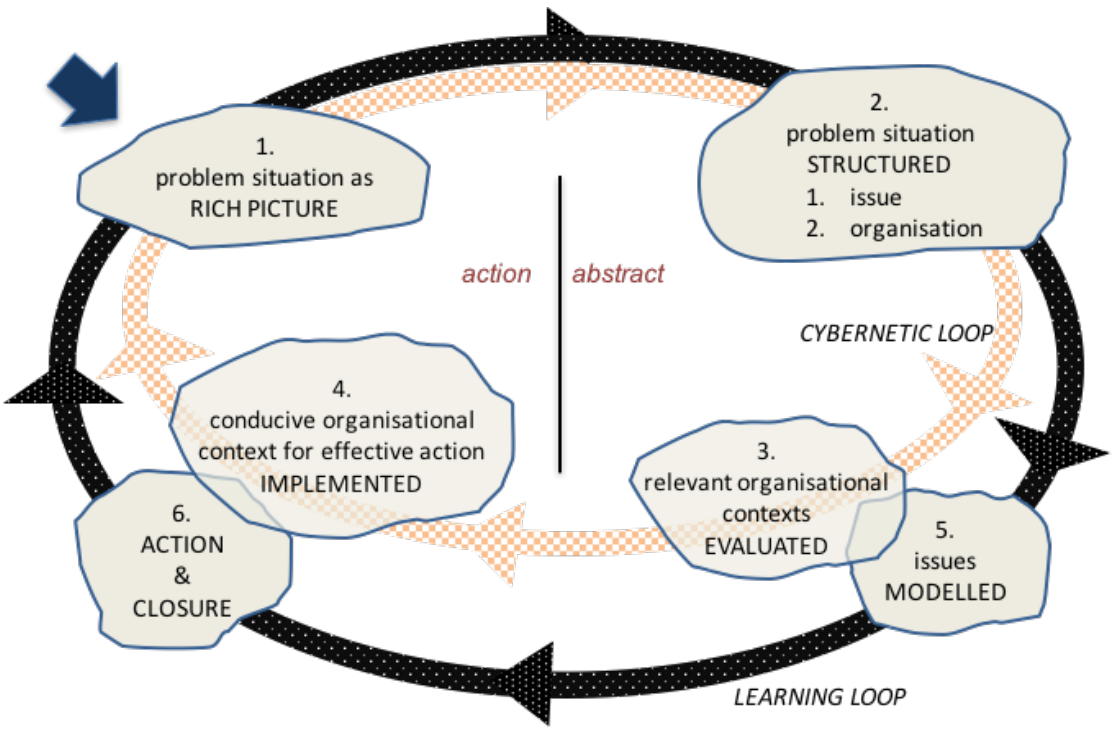

Figure 1 The Cybernetic Methodology (after Harwood, 2011)

It makes the distinction between a Learning Loop (where the focus is upon the learning associated with dealing with the complexity of a situation) and a Cybernetic Loop (which aims to create conditions for appropriate discussion and effective action). Conducive conditions are constituted when the appropriate people are organised to allow their participation. Its six activities (#1 to #6: Figure 1) commence with understanding the situation and creating a rich picture (#1). The structuring (#2) of this insight allows

possible problems to emerge and the respective stakeholders to be identified. This leads to the evaluation of relevant organisational contexts whereby the organisation and governance of participants is evaluated (#3), which leads to the establishing of the agreed organisational context (#4) to enable action and closure (#6). The chosen problem is examined, with modelling (e.g. the proposed WEF nexus model) being used to evaluate possible solutions (#5), leading to the implementation of the proposed solution (#6). This is likely to be an iterative process involving the redefinition of what is to be addressed and who is to be involved and how. Moreover, and counter to Stirling's (2015) view, it embraces a mix of complementary methods.

It is proposed that this methodology offers an approach to address the complexity of WEF Nexus and the concerns of both Stein et al. (2014) and Stirling (2015). It supports 'systems thinking'. However, the systems approach entails a number of challenges. First, is the definition of the system, which entails identifying what it 'is' (identity) and demarking its boundaries. Second, is the need to establish what needs to be recognised within the system. Third, concerns the manner in which culture, power and politics is given account. To add are the pragmatic issues identified by Bazilian et al. (2011: 7902): "The different vocabularies, competing priorities, institutional capabilities, and regulatory regimes between the three areas all encourage ''silo thinking'' in decision-making bodies". Nevertheless, with the appropriate facilitation, then perhaps more effective and appropriate solutions can be implemented for WEF nexus problems.

3.0 Making Sense of WEF Nexus drawing upon the Cybernetic Methodology

A full account of the application of the Cybernetic Methodology is beyond the scope of this paper. However, it can be used to explore several issues. The first relates to making sense of what constitutes the WEF nexus, drawing upon a rich understanding of the situation (#1) to model the issues (#5). This invokes a need to make sense of governance issues, drawing attention to the 'Viable System Model' (#5). In the Mekong example, the context of a possible WEF nexus debate can be potentially located at any of multiple levels, raising the question of who the requisite stakeholders are (#2) and what the problem is that is to be tackled (#2). Moreover, this leads to an examination of how the requisite participant stakeholders are to be organised (#3) in order to create organisational conditions conducive for making things happen (#6). In the context of the Mekong River Basin, whilst it can be argued that the Mekong River Commission is one such organisation, its trans-national scope is facilitating but is also restricted due the vested interests of its member nation states. In contrast, a country-wide initiative (Thailand's 'New Theory') to promote self-sufficiency (i.e. in water, energy and food [WEF]) at the level of the farm (#5, #6), demonstrates the relative effectiveness of a regional infrastructure to support its uptake.

3.1 A Conceptualisation of WEF Nexus

One of the issues previously mentioned is that the concept of WEF nexus is vague. The term 'nexus' has a variety of definitions offered by the Oxford English Dictionary (OED) which include:

1. A bond, link, or junction; a means of connection between things or parts; (also) the state of being connected or linked.
2. A connected group or series; a network.

3. A central point or point of convergence; a focus; a meeting-place.

OED (accessed online: 14th July, 2017)

In the context of WEF, the first definition draws attention to the connectivity between each of the elements, water, energy and food, which the second draws attention to each element being part of a group However, the third definition invokes more than connectivity, rather their fusion with the social context within which they have meaning. This suggests that an appropriate definition of WEF nexus draws upon the concept of 'meeting-place', since it can invoke a space where people get together on an on-going basis to exchange understandings and experiences, with view to learning and taking home to implement, whether in terms of research or practice. A nexus is thus a social space. It might be a local market or a global forum. A nexus, where people meet, can thus take place at multiple levels, with consequent actions having impact at respective levels, whether very local, regional or more global. Since it invokes the complexity associated with the myriad of possibilities of the relations among water, food and energy, with the criteria that relations are location specific and that which emerges reflects interest groups (Keskinen et al., 2016), then this calls for an approach that is location specific, in terms of stakeholders and their understanding of both local issues and the broader context, but is also systemic in terms of making sense of the associated complexity.

By regarding a nexus as a meeting place, which by implication, is a social space, then what is the nature of this social space? The lowest possible unit of analysis is the individual, but this is not a social space. Instead, the lowest meaningful unit is the community, whether this is a town, village - or a farm? It is proposed that the social space that is core to the nexus, within which the fundamental need of water, energy and food has meaning, is the community. This community comprise both individuals and organisations (e.g. businesses and services) that inhabit this space. However, this community can be perceived as existing at multiple levels, for example, whether a global community or a local community, or some intermediate community, invoking the notion of a 'WEF nexus complex'. This raises the question of what is the community in focus and how other levels are viewed relative to this. To add is the question of how the community sustains itself over time. These questions will be revisited in the next section. However, sustainability of the community draws attention to the dimensions of sustainability that need to be considered. The World Tourism Organization (UNWTO) / United Nations Environment Programme (UNEP) have recognised that sustainability is an important community issue and have recognised the three dimensions of social, environmental and economic, these being the 'three pillars of sustainability' (UNWTO/UNEP, 2005: 9). By addressing these three dimensions the community can sustain itself over time.

An additional consideration is contextual. Scott, et al. (2011) argue for the need to consider institutions, perceived as multi-tiered, as part of the nexus. Further, technological developments are core to nexus developments. This invokes the concept of 'Triple Helix', introduced by Etzkowitz and Leydesdorff in 1995 and explained in Leydesdorff & Etzkowitz (1996). The 'Triple Helix' concerns the role of institutions in technological development. This makes the distinction between universities (the 'internal dynamics of knowledge production'), government (politics / governance) and industry (the 'economic dynamics of the market'), but also draws attention to the communicative relations between them. Moreover, it is argued that governance "can be generalized to the concept of a nested structure of reflexive controls" (Leydesdorff & Etzkowitz, 1996: 281).

The consequent model (Figure 2) focuses upon community and provides an epistemological device to allow discourse and learning among the different relevant stakeholders, about the salient issues relating to water, energy and food (WEF), from each of the respective perspectives of the dimensions of social, economic and environmental sustainability, as well as accommodating the roles of the institutional context.

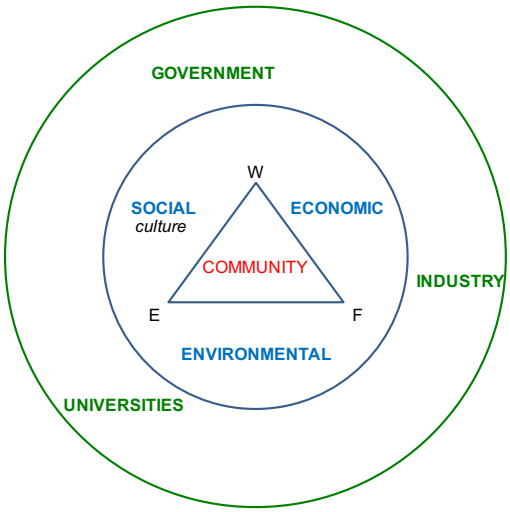

Figure 2 A derived model of the WEF nexus

Whilst this model draws attention to normative topics for discourse, acknowledging that they are interconnected, it requires an additional more sophisticated model to make sense of the organisational and governance aspects revealed here. This recognises the community as part of a multi-level regulatory system that governs WEF Nexus, within which the respective stakeholders from government, industry and university have their respective roles.

3.2 Modelling Organisation & Governance

Stein et al. (2014: 3) claim that "Governing the nexus is probably one of the grand challenges of the 21st century". However, Kurian & Adrakanian (2015) draw attention to the fragmentary nature of environmental governance mechanisms, poor evidence to support decisions, the importance of local government, the potentially beneficial role of the private sector and the inequitable distribution of benefits. Likewise, Al-Saidi & Elagib (2017: 1136) argue that the "nexus governance is poorly conceptualised".

The development of governance implies an understanding of how governance impinges upon practices. It is argued that governance needs to be viewed as multi-tiered (Scott, et al. ,2011), nested (Leydesdorff & Etzkowitz, 1996) or as multi-level (e.g. household, community, municipal, region... state) (Scott et al., 2015; Benson et al., 2015). Further that there might be an "optimal arrangement of nexus governance" involving decentralisation and co-ordination, reflecting the different stakeholders (Bhaduri et al., 2015: 726). This multi-level view with decentralisation invokes a hierarchical model of governance. However, hierarchies invoke authoritative structures that control by command, and thus tend to lack the requisite variety to handle environmental complexity (Espejo, 1989, 1992c, 1999). In contrast, this need to handle environmental complexity invokes recursively distributed governance structures (discretion – self-sufficiency) that

use co-ordination as a primary aligning mechanism (Espejo, 1989, 1992c, 1999). Co-ordination and collaboration are essential mechanisms to overcome issues due to fragmented policies (Weitz et al., 2017). However, decentralised structures are likely to increase the number of those employed, increase costs, loose economies of scale and raise problems of co-ordination (Veiga & Kurian, 2015). To add is the challenge of how to manage the appropriate, equitable and transparent distribution of centralised funds and how accountability is managed against the backdrop of political pressures (e.g. electorate related) and local corruption. One model which appropriately facilitates the analysis of distributed governance structures is the Viable System Model.

3.3 The Viable System Model (VSM)

The Viable System Model (VSM) was produced by Stafford Beer (Beer, 1972, 1979, 1983, 1984, 1985), developed by others (e.g. Espejo & Harnden, 1989; Espejo, 1999) and applied to a variety of contexts (e.g. Allende's Chile: Beer, 1981, Espejo 1990; the Scottish Tourism Industry: Harwood, 2009; an Amazonian association of indigenous communities: Espinosa & Duque, 2017). It is a model of how a 'primary activity' is regulated to increase the likelihood of acceptable outcomes or reduce the likelihood of undesirable outcomes (Figure 3). This primary activity is the essence (purpose) of what the entity does, for example, the name 'community', which establishes the entity's identity, reveals its activity as all that relates to it 'being' a community. Its regulation comprises five mechanisms (Figure 3). First is the co-ordination of all that which constitutes the primary activity (e.g. to be a community). Second are the controls which enable stable co-existence within the community (e.g. (self-)imposed rules as well as negotiated agreements amongst community members), These are monitored (audited) on an ad hoc basis to verify that things are what they should be. Third are the (Intelligence) mechanisms that relate to understanding what is going on outside and what this means for the community. Together with Control these mechanisms serve as an adaptation mechanism, allowing on-going aligned engagement between the community and outside. Closure to this configuration of mechanisms is provided by Policy, which provides direction. The community is an example of a regulated primary activity, which denotes an entity or system which performs this activity. A regulated system has a degree of autonomy, but exists within a recursive structure of meta- and sub- systems.

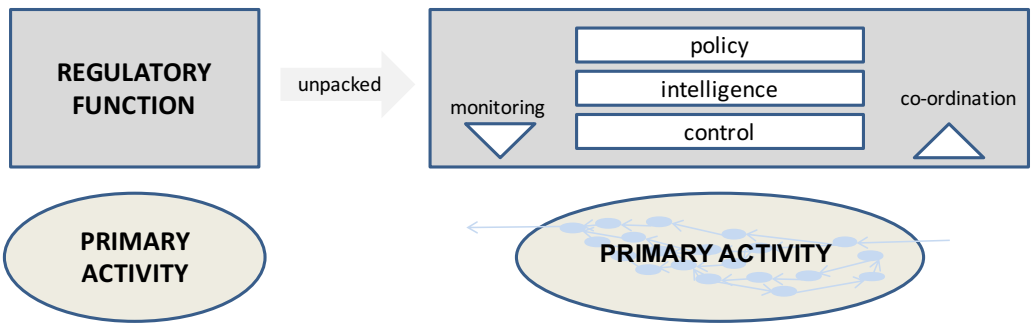

Figure 3 Regulating a primary activity (after Harwood, 2011)

This very simple overview of the VSM permits the multi-level nature of the embedded community to be unfolded to reveal how the discretion to make decisions that affect the community is distributed over the different levels that comprise of the activities that constitute the whole structure. In other words, it reveals the distribution of governance in terms of what exists. A method to guide the analysis / diagnosis using the VSM is

presented in Espejo et al. (1999). However, the VSM can also be used in a design mode to create a desirable governance structure for a project. A precedent for the use of VSM at a national level is that of Chile in the early 1970s as narrated by Medina, (2006). Thus, it is not enough to make decisions about a new irrigation project that affects surrounding communities. It is also necessary to consider the social and regulatory implications of what shifts from a technically coherent project to one that involves lots of people and becomes a complex situation. The question arises of whether such a decision is unilaterally imposed, with those affected making do and also with possible unwanted sustainability issues, or whether decisions are democratically taken with view to the most appropriate outcome for the community in alignment with the principles of WEF Nexus. Thus, the determination of desirable governance is the outcome of discourse amongst the relevant stakeholders, which invokes a methodology to facilitate the use of the VSM in a design mode.

3.4 The Mekong River Basin (MRB)

The Mekong River Basin, (MRB) offers an interesting case, revealing a high level of complexity, multiple levels of governance and with WEF nexus being an important issue.

The spine of the MRB is the Mekong river, which weaves from the Himalayas through South-East Asia to emerge into the South China Sea at the Mekong Delta in the south of Vietnam. It offers not only very rich bio-diversity, but is home to over 70 million people, many of whom are subsistence farmers (MRC, 2013). It is perhaps underdeveloped relative to many other major river systems, due to factors including conflicts and lack of financial resources (MRC, 2013). As such, it maintains a more natural state permitting a more considered sustainable approach to its future development (MRC, 2013). Nevertheless, the Mekong faces potentially destabilising factors, which include hydropower developments (damming) and climate change (rising sea levels) (MRC, 2016).

One of the challenges is to develop the MRB in a sustainable manner (MRC, 2015). When the MRB is abstractly unfolded to reveal its complexity, a multiple of levels can be revealed (Figure 4). Normally, any unfolding would be based upon the names used in discussion to identify the respective entities that constitute the multiple levels. Irrespective, many of the entities in this case relate to geographically bounded locations. Nevertheless, each entity has the potential for discretion to make its own decisions. The obvious in terms of the policies (rules) and agreements (negotiations) are the UN, ASEAN and the sovereign states. The other levels will equally have the potential for regulatory elements, but how well do they function and how co-ordinated are these, especially with regard to addressing the issues of the WEF Nexus? Indeed, his unfolding reveals the WEF ‘nexus complex’; that whilst the focus of an WEF activity is likely to be upon a specific named location, with all that this comprises, this location is part of a meta-location as well as comprises of sub-location (i.e. location can be viewed in terms of multiple levels).

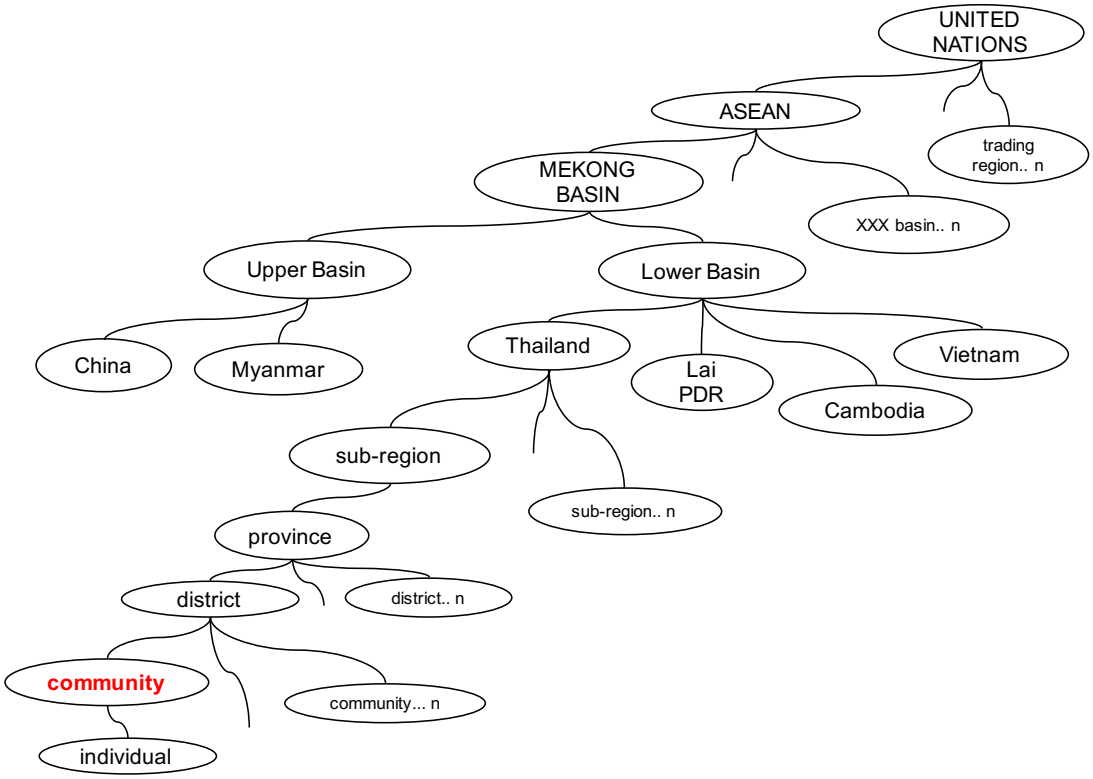

Figure 4 The unfolding of the complexity of the Mekong River Basin

This unfolding establishes the structural framework to allow more focused evaluation. Amongst the many developments are two which have shaped how Thailand has developed. The first relates the governance of the Lower Mekong Basin (Mekong River Commission), whilst the second relates to innovation within Thailand (The Royal Projects).

3.4.1 Mekong River Commission (MRC)

The Mekong River Commission (MRC) was established in 1995 as an inter-governmental organisation to "promote, support, cooperate and coordinate in the development of the full potential of sustainable benefits to all riparian States and the prevention of wasteful use of Mekong River Basin waters…" (MRC, 1995: 3). The MRC builds upon the activities of its predecessor, the Mekong Committee, established in 1957. China and Myannmar (with sovereignty over the Upper Mekong Basin) became Dialogue Partners in 1996. Presiding over the MRC is a Council which has ministerial level representation from each country (MRC, 2011). Its management board comprises the Joint Committee, with technical and administrative functions performed by the Secretariat (MRC, 2017a).

The MCR facilitates cooperation on a range of sustainability related issues:

> sustainable development, utilization, management and conservation of the water and related resources of the Mekong River Basin including, but not limited to irrigation, hydro-power, navigation, flood control, fisheries, timber floating, recreation and tourism, in a manner to optimize the multiple-use and mutual benefits of all riparians and to minimize the harmful effects that might result from natural occurrences and man-made activities. (MRC, 2011: 3)

This has resulted in a series of Procedures, which include Procedures for Water Quality, Data and Information Exchange and Sharing and the Maintenance of Flows on the Mainstream. This is underpinned by a succession of five year Strategic Plans (to guide the activities of the MRC Secretariat), two keystone Basin Development Strategies (BDS) (2011-2015, 2016-2020) and the Integrated Water Resources Management (IWRM) Project. In recognition of the need for organisational reform, a commissioned technical paper (Schmeier, 2010) advises on the different structures of River Basin Organisations, drawing attention to the distinction between centralisation and decentralisation.

Some of the challenges suggested by the VSM relate to a shared sense of direction, cooperation and the consequent shared understanding of issues and establishing of effective co-ordinatory mechanisms amongst nation states to ensure mutually acceptable responses and the emergence of appropriate practices. However, this raises the question of how the Strategic Plan translates into respective national policies and how these cascade down into effective practices by the ordinary citizen in the community. Further, how aligned are political interests to the collective welfare and interests of the population and the sustainable requirements of the land, sea and air? The essence of this example is to reveal the complexity of the structural issues required to permit appropriate communication, negotiation and agreement.

3.4.2 'New Theory'

The 'New Theory' is an initiative that provides for farmer self-sufficiency from a small land plot. It is perhaps an exemplar of a successful WEF nexus engagement. It is one of the many inspiring initiatives of King Bhumibol Adulyadej, through his Royal Projects (ORDPB, 2015). Underlying the Royal Projects are concepts / theories and general principles, these being concisely explained in DTEC (1997). Since the first Royal Project in 1952, there have been over 4,500 projects by the end of 2014 (ORDPB, 2015). One important facet of this is the setting up of six Royal Development Study Centres (RDSCs) throughout Thailand between 1979 and 1983. These demonstration sites both promote initiatives to improve farming practices as well as co-ordinate the involvement of the different government agencies (ORDPB, 2015).

Core to 'New Theory' is the growing of rice as staple food, with a reservoir providing water for irrigation and also fish as well as the rest of the land offering the potential for supplementary income. As explained in DTEC (1997) for a farm plot of 15 rai (~6 acres), the formula specifies a land use ratio of 30:30:30:10, (i.e. 30% paddy (5 rai), 30% farm crops / fruit (5 rai), 30% farm pond 4 metres deep (3 rai) and 10% house and other use (2 rai) (Figure 5). To compensate for evaporation, a local reservoir can be used to add water to the farm pond. This concept of self-sufficiency has been developed further to incorporate the concept of farmers organising themselves into co-operatives to address such issues as marketing, welfare, education and social work. In this manner, the notion of self- sufficiency has been extended to the rural community (DTEC, 1997).

Figure 5 A model of the 'New Theory' (photo taken with thanks to Kasetsart University Chalermphrakiat Sakonnakhon Province Campus)

This case reveals the autonomy of this farm unit informed by the Royal Development Study Centres. Whilst the focus is the farm, this reflects the successful translation of a policy / theory from a higher level into practice via the facilitating and co-ordinating mechanism of the Royal Development Study Centres operating at a regional level. However, farmers have the discretion of deciding whether to embrace these practices or be influenced by competing commercial interests regarding land use, with possible negative impact upon their land by unsustainable commercial practices (e.g. bad land management). Moreover, farmers embracing New Theory have recognised the value of collaborating in higher level co-operative groups. raising questions about the nature of the governance of the co-operatives.

4.0 Conclusion

A response to the call for a WEF nexus approach that is systemic, can handle its associated complexity, ambiguity and vagueness, as well as the multiple stakeholders, each with their respective viewpoint, and the implied governance implications, is challenging.

Nevertheless, by turning to methodologies (PSMs) that deal with complex problem situations, where it is unclear what the problem is, then it is possible to identify appropriate pragmatic approaches. One PSM is the Cybernetic Methodology, a conceptually grounded methodology, which guides a facilitator through a series of activities, starting with understanding the situation, to allow the emergence of a problem agreeable to the disparate participant stakeholders, and which ultimately leads to action. One feature of this is the attention given to creating the organisational conditions conducive for problem solving and action. Likewise, is the attention given to modelling the problem situation. In the context of what is a WEF nexus, the concept of a WEF nexus complex is introduced,

which centres upon the notion of 'meeting' within the social entity of the community, as an element of a recursive organisational structure. Organisational governance issues, whether related to creating conducive organisational conditions or to organisational aspects of proposed solutions, are effectively modelled using the VSM, revealing the multi-level perspective and drawing attention to the relevant governance mechanisms (e.g. co-ordination). The example of the Mekong River Basin, is used in an analytical mode, allowing a glimpse at its complexity. It is concluded that the approach presented offers a powerful means to address the complexity of WEF nexus and, as such, should be used in an appropriate 'mess' to demonstrate the reality of its potential.

References

1. Ackoff, R. L. (1974). *Redesigning the Future*. New York: John Wiley and Sons.
2. Al-Saidi, M., & Elagib, N.A. (2017) Towards understanding the integrative approach of the water, energy and food nexus. *Science of The Total Environment*, 574, 1131-1139.
3. Allan, J.A. (2003) Virtual Water - the Water, Food, and Trade Nexus. Useful Concept or Misleading Metaphor? *Water International*, 28(1), 106-113.
4. Allouche, J., Middleton, C. and Gyawal, D. (2014) Nexus Nirvana or Nexus Nullity? A dynamic approach to security and sustainability in the water-energy-food nexus. STEPS Working Paper 63, Brighton: STEPS Centre.
5. Bazilian, M., Rogner, H., Howells, M., Hermann, S., Arent, D., Gielen, D., Steduto, P., Mueller, A., Komor, P., Tol, R.S. and Yumkella, K.K. (2011) Considering the energy, water and food nexus: Towards an integrated modelling approach. *Energy Policy*, 39(12), 7896-7906.
6. Beer, S. (1972) *Brain of the Firm*. London: Allen Lane.
7. Beer, S. (1979) *The Heart of Enterprise*. Chichester: John Wiley and Sons.
8. Beer, S. (1981) *Brain of the Firm*. [2nd ed.] Chichester: John Wiley and Sons.
9. Beer, S. (1983) A reply to Ulrich's 'Critique of pure cybernetic reason: the Chilean experience with cybernetics'. *Journal of Applied Systems Analysis*, 10, 115-119.
10. Beer, S. (1984) The viable system model: its provenance, development, methodology and pathology. *Journal of the Operational Research Society*, 35(10), 7-25.
11. Beer, S. (1985) *Diagnosing the System for Organisations*. Chichester: John Wiley and Sons.
12. Benson, D., Gain, A., & Rouillard, J. (2015) Water governance in a comparative perspective: From IWRM to a 'nexus' approach?. *Water Alternatives*, 8(1), 756-773
13. Bhaduri, A., Ringler, C., Dombrowski, I., Mohtar, R. & Scheumann, W. (2015) Sustainability in the water–energy–food nexus, *Water International*, 40:5-6, 723-732.
14. Bowling, D., & Espejo, R. (1992). An intervention with the cybernetic methodology in regent engineering. *Transactions of the Institute of Measurement and Control*, *14*(1), 17-28.
15. Bowling, D., & Espejo, R. (2000) Exploring computer supported cooperative work in a retail bank. In: J Allen and J Wilby (eds) ISSS 2000 International Society for the Systems Sciences: accession number 20151. CD-ROM, Toronto.
16. Cairns, R & Krzywoszynska, A. (2016) Anatomy of a buzzword: the emergence of 'the water-energy-food nexus' in UK natural resource debates. *Environmental Science & Policy*, 64, 164-170.

17. Checkland, P. (1972) Towards a systems-based methodology for real-world problem solving. Journal of Systems Engineering, 3(2) p87-116.
18. Checkland, P. (1981) *Systems Thinking, Systems Practice*. Chichester: John Wiley & Sons.
19. Checkland, P. (1999) *Soft Systems Methodology: a 30-year retrospective*. Chichester: John Wiley & Sons Ltd.
20. Churchman, C.W. (1967) Guest Editorial, Wicked Problems. *Management Science*, 14(4), B141-B142.
21. Cornwall, A. (2007) Buzzwords and fuzzwords: deconstructing development discourse. *Development in Practice,* 17(4-5), 471-484
22. DTEC (1997) *Concepts and Theories of His Majesty the King on Development*. The Department of Technical & Economic Cooperation / United Nations Development Programme (English translation)
23. Endo, A., Tsurita, I., Burnett, K., & Orencio, P. M. (2017) A review of the current state of research on the water, energy, and food nexus. *Journal of Hydrology: Regional Studies*, 11, 20-30.
24. Espejo, R. (1988) Cybernetic Methodology to Study and Design Human Activities. PhD Thesis, Aston University, Birmingham.
25. Espejo, R. (1989) The viable system model revisited. In Espejo, R. & Harnden, R. (eds), *The Viable System Model: Interpretation and Applications of Stafford Beer's VSM*. Chichester: John Wiley and Sons.
26. Espejo, R. (1990) Complexity and change: Reflections upon the cybernetic intervention in Chile, 1970–1973. *Systems Practice*, 3(3) p303-313.
27. Espejo, R. (1992) Management of complexity in problem solving. *Transactions of the Institute of Measurement and Control,* 14(1) 8–16.
28. Espejo, R. (1999) Aspects of Identity, Cohesion, Citizenship and Performance in Recursive Organisation. *Kybernetes*, 28(6/7) p640-658.
29. Espejo, R. (2015a). An Enterprise Complexity Model: Variety Engineering and Dynamic Capabilities. *International Journal of Systems and Society (IJSS)*, *2*(1), 1-22.
30. Espejo, R. (2015b). Performance for viability: complexity and variety management. *Kybernetes*, 44(6/7), 1020-1029.
31. Espejo, R. and Harnden, R.J. (Eds) (1989) The Viable System Model: Interpretation and Applications of Stafford Beer's VSM. Chichester: John Wiley and Sons.
32. Espejo, R., & Reyes, A. (2011). Organizational systems: Managing complexity with the viable system model. Springer Science & Business Media.
33. Espejo, R., Bowling, D. & Hoverstadt, P. (1999) The viable system model and the Viplan software. *Kybernetes*, 28(6/7), 661-678.
34. Espejo, R., Schuhmann, W., Schwaninger, M. & Bilello, U. (1997) *Organizational Transformation and Learning*. Chichester: John Wiley & Sons.
35. Espinosa, A. & Dugue, C. (2017) Complexity management and multi-scale governance: A case study in an Amazonian Indigenous Association. *European Journal of Operational Research*, In press, corrected proof, Available online 21st July 2017.
36. Etzkowitz, H. & Leydesdorff, L. (1995) The Triple Helix---University-Industry-Government Relations: A laboratory for knowledge based economic development. EASST Review 14 (1995, nr. 1) 14-19.
37. Finley, J.W., & Seiber, J.N. (2014) The nexus of food, energy, and water. *Journal of Agricultural and Food chemistry*, 62(27), 6255-6262.

38. Flammini, A., Puri, M., Pluschke, L. & Dubois, O. (2014) *Walking the Nexus Talk: assessing the Water-Energy-Food Nexus in the Context of the Sustainable Energy for All Initiative*. Environment and Natural Resources Management Working Paper No. 58. Rome: Food and Agriculture Organization of the United Nations (FAO).
39. Harwood, S.A. (2009) The changing structural dynamics of the Scottish tourism industry examined using Stafford Beer's VSM. *Systemic Practice and Action Research*, 22(4), 313-343.
40. Harwood, S.A. (2012) The management of change and the Viplan Methodology in practice. *Journal of the Operational Research Society*, 63(6), 748–761.
41. Hoff, H. (2011). *Understanding the Nexus*. Background Paper for the Bonn2011 Conference: The Water, Energy and Food Security Nexus. Stockholm Environment Institute, Stockholm.
42. ICIMOD (2012). Contribution of Himalayan ecosystems to water, energy, and food security in South Asia: A nexus approach. Kathmandu, Nepal: International Centre for Integrated Mountain Development (ICIMOD).
43. IISD (Bizikova, L., Roy, D., Swanson, D., Venema, H.D. & McCandless, M.) (2013) The Water–Energy–Food Security Nexus: Towards a practical planning and decision-support framework for landscape investment and risk management. Winnipeg: The International Institute for Sustainable Development (IISD).
44. Keskinen, M., Guillaume, J. H., Kattelus, M., Porkka, M., Räsänen, T. A., & Varis, O. (2016) The water-energy-food nexus and the transboundary context: Insights from large Asian Rivers. *Water*, 8(5), 193.
45. Kurian, M., & Ardakanian, R. (2015). The nexus approach to governance of environmental resources considering global change. In. Kurian, M., & Ardakanian, R. (eds.) *Governing the Nexus*. Cham: Springer International Publishing.
46. Leydesdorff, L. & Etzkowitz, H. (1996) Emergence of a Triple Helix of University-Industry-Government Relations. *Science and Public Policy*, 23(5), 279-286.
47. McCalla, A. (1997) The Water. Food, and Trade Nexus. Paper delivered at MENA-MED Conference convened by the World Bank in Marrakesh, May 1997.
48. Medina, E. (2006) Designing Freedom, Regulating a Nation: Socialist Cybernetics in Allende's Chile. *Journal of Latin American Studies*, 38(3), 571-606.
49. Mingers, J. & Rosenhead, J. (2004) Problem Structuring Methods in Action. *European Journal of Operational Research*, 152, 530–554.
50. MRC (1995) *Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin*. Phnom Penh: Mekong River Commission.
51. MRC (2011) *Planning Atlas of the Lower Mekong River Basin.* Phnom Penh: Mekong River Commission.
52. MRC (2013) *The BDP Story: Mekong Basin Planning – The story behind the development plan*. Phnom Penh: Mekong River Commission.
53. MRC (2015) *20 Years of Cooperation*. Phnom Penh: Mekong River Commission.
54. MRC (2016) *Strategic Plan 2016-2020.* Phnom Penh: Mekong River Commission.
55. MRC (2017) Governance and Organisational Structure. http://www.mrcmekong.org/about-mrc/governance-and-organisational-structure/ [accessed 31st July 2017]
56. Muller, M. (2015). The 'Nexus' As a Step Back towards a More Coherent Water Resource Management Paradigm. *Water Alternatives*, 8(1), 675-694.

57. ORDPB (2015) *The Developer King*. Bangkok: Office of the Royal Development Projects Board.
58. Pahl-Wostl, C. (2017) Governance of the water-energy-food security nexus: A multi-level coordination challenge. *Environmental Science & Policy*, In press, corrected proof, Available online 12th August 2017.
59. Schmeier, S. (2010) The Organizational Structure of River Basin Organizations: Lessons Learned and Recommendations for the Mekong River Commission (MRC). Technical Background Paper, prepared for the Mekong River Commission (MRC), Final Draft, 10 June 2010, Hertie School of Governance, Berlin.
60. Scott, C. A., Kurian, M., & Wescoat Jr, J.L. (2015). The water-energy-food nexus: Enhancing adaptive capacity to complex global challenges. In. Kurian, M., & Ardakanian, R. (eds.) *Governing the Nexus*. Cham: Springer International Publishing.
61. Smajgl, A., Ward, J., & Pluschke, L. (2016). The water–food–energy Nexus–Realising a new paradigm. *Journal of Hydrology*, 533, 533-540.
62. Stein, C., Barron, J. & Moss, T. (2014) *Governance of the nexus: from buzz words to a strategic action perspective*. The Nexus Network, SPRU, Nexus Network Think Piece Series, Paper, 3. Brighton: University of Sussex.
63. Stirling, A. (2015). *Developing 'Nexus Capabilities': towards transdisciplinary* methodologies. The Nexus Network, Discussion Paper. Brighton: University of Sussex.
64. UNDESA (2012) *Synthesis of Energy-Related Issues Highlighted in National Reports of RIO+20*. New York: United Nations Department of Economic and Social Affairs (UNDESA).
65. UNWTO/UNEP (2005) *Making Tourism More Sustainable, A guide for policy makers*. Madrid: World Tourism Organization; Paris: United Nations Environment Programme.
66. Veiga, L.G., & Kurian, M. (2015) Intergovernmental fiscal relations: Questions of accountability and autonomy. In. Kurian, M., & Ardakanian, R. (eds.) *Governing the Nexus*. Cham: Springer International Publishing.
67. Water in the West (2013) *Water and Energy Nexus: a literature review*. Stanford: Stanford University.
68. Weitz, N., Strambo, C., Kemp-Benedict, E., & Nilsson, M. (2017b) Closing the governance gaps in the water-energy-food nexus: Insights from integrative governance. *Global Environmental Change*, 45, 165-173.
69. Wichelns, D. (2017) The water-energy-food nexus: Is the increasing attention warranted, from either a research or policy perspective?. *Environmental Science & Policy*, 69, 113-123.